

Cinema Audio Processing System

Field of the invention

The present invention relates to the processing of audio for reproduction in a cinema type audience environment.

5 Background of the invention

The utilisation of audio reproduction in a cinema type environment is well known in the art. Examples of popular reproduction formats include the Dolby® Digital format and the DTS format.

10 In the Dolby® Digital format, the cinema track is recorded in a five channel format for reproduction over five speakers. The five channel format includes a front left, front centre and front right channel and a rear left and right channel. The input audio format is designed for reproduction in a cinema type environment where five speakers are placed around an audience. An example of the format is illustrated schematically in Figure 1 wherein, in a cinema environment 1, two audience members 2A and 2B are placed with five speakers 3-7 being placed around the audience members. The audio track of the movie is then mixed in a
15 five channel format for reproduction in such an environment.

The utilisation of a system such as that in Figure 1 is thought to provide for enhanced spatialization capabilities of an audio track. The five channel format allows a listener to experience a degree of spatialization due to the "mix" previously encoded. Hence, the audio
20 format of Figure 1 has become quite popular.

Unfortunately, the arrangement of Figure 1 has a number of drawbacks. For example, where an audience member 2C is located near to one of the speakers then the speaker source 7 is likely to drown out the other speaker sources. As a result, the spatialization effects will be substantially lost. Further, the degree of spatialization that can be provided to the audience is
25 limited as a result of the limitations of the choice provided by a five track arrangement.

Summary of the invention

In accordance with a first aspect of the present invention, there is provided in a multi viewer environment where multiple viewers simultaneously experience an audio-visual

The panning means further preferably can include delay means for delaying the output of one speaker relative to another by an amount that varies with the panning gain.

Brief description of the drawings

Notwithstanding any other forms which may fall within the scope of the present invention, preferred forms of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 illustrates schematically a standard cinema speaker arrangement;

Figure 2 illustrates one form of a speaker arrangement in accordance with the method of the present invention;

Figure 3 illustrates the process of panning a sound from one speaker to another so as to simulate an audio trajectory;

Figure 4 is a graph of panning magnitudes in panning a sound from a first speaker to a second speaker;

Figure 5 illustrates the utilization of delay processing in panning signals;

Figure 6 illustrates a portion of a speaker layout in a cinema environment;

Figures 7 to 9 illustrate, respectively, graphs of amplitude, delay and listener delay components in panning signals in the speaker arrangement of Figure 6;

Figure 10 illustrates schematically a first signal processing embodiment; and

Figure 11 illustrates schematically a second signal processing embodiment.

Description of preferred embodiments

In the preferred embodiment, an alternative audio arrangement is proposed. This alternative arrangement can be as illustrated in Figure 2 wherein a series of speakers 10 to 19 are placed down each side of the cinema audience. Additionally, a series of speakers 20 to 25 can optionally be placed at the back of the listening audience. The arrangement of Figure 2 allows for a larger degree of spatialization of audio tracks around a listener whilst maintaining a degree of "coherence" in the sound registering at the ears of each audience

factors such as speaker separation, the number of speakers in the array, the speed of the virtual sound source, the proximity of the speakers to audience members and the size of the audience.

In this manner, an improved sound rendering is provided which allows for an improved listening experience for those located off centre of the arrangement of Figure 3, thereby providing for a more linear response to moving sound sources. The arrangement discussed in respect of Figure 3 can be extended to an audience environment and, for example, projecting virtual sounds travelling down the side of the audience. Such an arrangement is illustrated schematically in Figure 6 wherein a listener 40 listens to a virtual sound source 41 which travels at a constant velocity down their right hand side so that moments later it is at the point 42. The sound source is played over speakers A to E.

In order to simulate the effect of the moving sound source, the sound is first panned along the speakers as is illustrated in Figure 7, with the signal to each speaker A-E in turn having its amplitude rise to a maximum and then decay. Similarly, as shown in Figure 8, the signal to each speaker is delayed depending on a current location of the virtual sound source. The delay can be in accordance with the discussion as mentioned in respect of Figure 3. In this case, however, it is extended to a multi-speaker arrangement. For the particular listener 40, the approximate overall delay will be similar to that shown in Figure 9 with the sound appearing to move along the right hand side of the speakers. Speaker A which is located furthest from the listener 40 will have the greatest delay while speaker D which is located adjacent the listener will have the least delay. Importantly, a second listener 45 also hears the sound moving along the series of speakers however with a slightly different delay pattern and timing sequence. A number of different systems incorporating the method of the preferred embodiment are possible.

In a first arrangement, where the speaker arrangement in a cinema is known, the audio track can be totally pre-rendered with custom sets of speaker feeds being created.

In alternative environments, the usual Dolby Digital type speaker feeds might be provided and separate mono channels provided with associated spatial information locating

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without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects to be illustrative and not restrictive.

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